

# KEMA Labs

**CESI** Group



## Ensuring Quality in Power Systems

Inspection, Factory Audit,  
Technical Investigations

# Who We Are

KEMA Labs is a globally recognized organization specializing in Testing, Inspections & Certification. With locations worldwide, we merge traditional methods with cutting-edge technology to test a wide range of grid equipment. This ensures compliance with the latest rigorous standards for performance and safety. We also provide quality assurance and advisory services, leveraging our horizontally integrated global expertise to support clients throughout the entire energy value chain.



**+4000**  
Global  
customers per year

**50+**  
Accredited Labs

**200+**  
Talented People

**6+**  
Labs & Offices  
Worldwide

# Industries Served

KEMA Labs is a globally recognized organization specializing in Testing, Inspections & Certification. With locations worldwide, we serve multiple industries by merging traditional methods with cutting-edge technology, supported by cross expertise and state-of-the-art facilities, to test a wide range of grid equipment.



## How Can OEMs Ensure Efficiency and Quality?

Achieving high efficiency while maintaining superior product quality is a significant challenge for OEMs. With the right partner, OEMs can maximize their investment in quality, ensuring their products meet the highest standards in the market. KEMA Labs, a CESI Group business unit, offers expertise in component testing and electrical system engineering to support this mission. Its Quality Assurance service goes beyond standard Quality Control, evaluating the entire factory rather than individual steps.

For manufacturers, this means better cost and risk management, along with globally recognized certification to boost sales. KEMA Labs address this mission using a specific methodology called "**Quality Assurance Toolbox**", supporting manufacturers at every stage of the value chain with dedicated services.

### Quality Assurance Toolbox



## Technical Review Services

The Design Review is a critical step in KEMA Labs' **Quality Assurance Strategy**, conducted before production to validate the design of main electrical equipments. This process ensures equipment is designed with adequate safety margins, focusing on:

Focus	Goal
<b>Product Life Cycle Optimization</b>	Ensuring compliance with international standards such as ISO 9001, IEC, and IEEE
<b>Effective Risk Management</b>	Identifying potential risks and implementing mitigation strategies, Conducting Failure Modes and Effects Analysis (FMEA) to address design flaws
<b>Compliance with Technical Specifications</b>	Verifying alignment with relevant technical specifications and standards, Ensuring dielectric, thermal, and mechanical requirements are met
<b>Verification of Known Weak Points</b>	Reviewing historical data to identify known weak points in similar designs, Implementing design improvements to address these weaknesses



## Factory Assessment Services

### *How to Strengthen Supplier Relationships*

The workflow followed by KEMA Labs during Supplier evaluation and Factory Assessment:

#### **Defining Scope**



Collaborate with company management to define the scope and boundaries of Quality Assurance (QA) processes. Ensure alignment with international standards such as ISO 9001, ISO/IEC 17025, and ISO/IEC 17020.

#### **Documentation Review**



Collect and review documentation to understand manufacturing processes. Verify compliance with relevant standards (e.g., IEC, IEEE) and technical specifications.

#### **Onsite Inspection**



Develop a content strategy that aligns with your goals and resonates with your target audience. Use a mix of formats such as images, videos, infographics, and blog posts. Be consistent with your content frequency and timing.

#### **Identification of Necessary Improvement**



Use analytics tools to track your social media performance and measure the success of your efforts against your goals. Analyze your metrics regularly and make data-driven decisions to improve your strategy.

#### **Comprehensive Report**



Use analytics tools to track your social media performance and measure the success of your efforts against your goals. Analyze your metrics regularly and make data-driven decisions to improve your strategy.

## Witnessing of Factory Acceptance Tests (FAT)

### Ensuring Quality Before Delivery

Routine and type tests in factory labs are the final steps in equipment manufacturing, ensuring proper production and performance. Our Services:

#### **Verification of Accuracy of Test Instrumentation Calibration:**

- Ensuring ISO/IEC 17025 compliance with certified calibration and full traceability for unmatched accuracy.

#### **Verification of Test Procedures and Layouts:**

- Reviewing procedures and setups to ensure IEC/IEEE/Client compliance and strict adherence to agreed protocols.

#### **Monitoring Test Parameters:**

- Continuous monitoring of test parameters for consistency, reliability, and complete data traceability.

#### **Evaluation of Test Results:**

- Expert review of results with actionable recommendations, ensuring compliance and equipment protection.



## Failure Investigation Services

Failure is defined as any deviation faced by an asset compared to its expected functionality which requires corrective action. When a failure occurs, a comprehensive failure analysis is essential to identify causes and prevent recurrence. The root causes of a failure may include:



**AGEING:** Failure occurred due to natural ageing of the component. Assessing the impact of wear and tear over time.



**DESIGN:** Failure occurred due to inadequate design of the component. Evaluating design flaws and ensuring compliance with international standards such as ISO 9001 and IEC.



**DAMAGE:** External factors damaging the component. Identifying environmental or accidental damage.



**INSTALLATION AND ASSEMBLY:** Workmanship during installation. Reviewing installation procedures and adherence to best practices.



**OPERATIONAL CONDITIONS AND EVENTS:** Analysing operational conditions and events leading to failure. Monitoring usage patterns and stress factors.



**MANUFACTURING PROCESS:** Deviations or missing Quality Control. Ensuring compliance with ISO/IEC and other relevant standards.

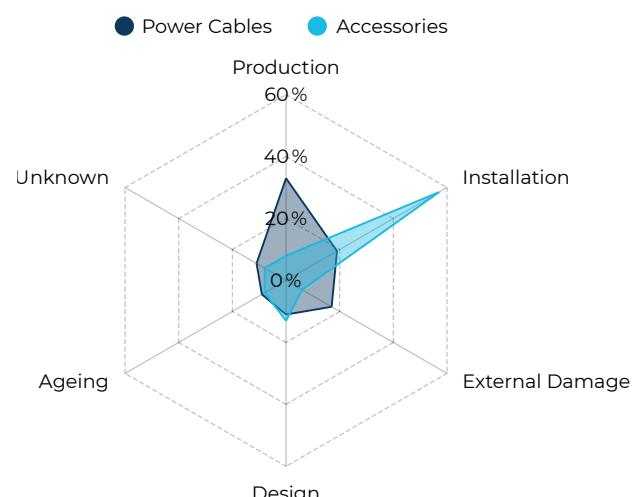
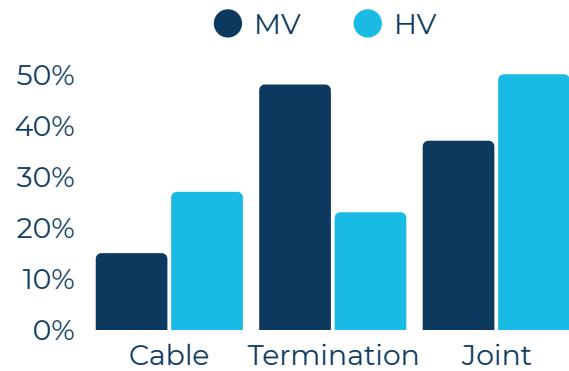


## Power Cable Failure Investigations

Most failures happens because of a handful of recurring factor along the chain from design to operation:

- **Design & specification** – stress-cone geometry, inadequate creepage distances, shielding, or insufficient margins for thermo-mechanical loads.
- **Production issues** – extrusion instabilities (e.g., flat spots), insulation/shrinkage defects, contaminated materials, or handling damage before shipment.
- **Installation workmanship** – improper jointing/termination, poor soldering, oils/greases in the wrong place, incorrect pre-heating, or misinterpretation of instructions. This is a major driver for accessory failures.
- **External conditions** – transport damage, third-party impacts, moisture ingress (sheath damage/water penetration), or extreme weather.
- **Ageing & duty** – thermal cycling, partial discharge (PD), or overvoltages gradually weakening insulation over time.

Component Failure Probability during Investigation





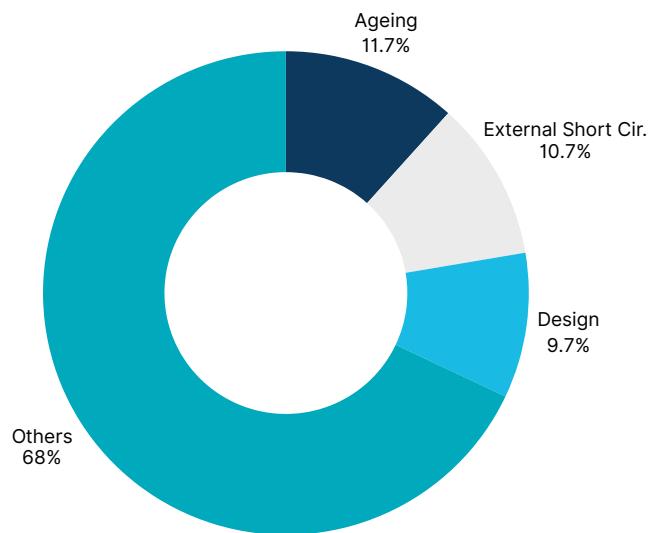
## Power Transformers Failure Investigations

### Common Causes of Transformer Failures:

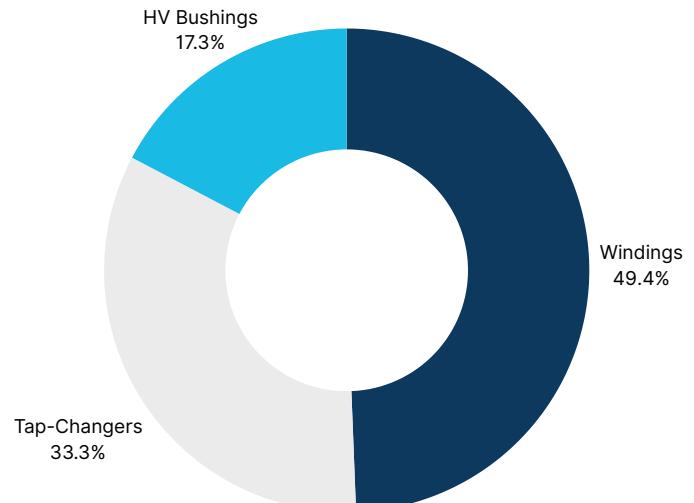
Industry studies highlight these major contributors:

- **Ageing & Thermal Stress** – Natural insulation degradation, accelerated by overloads and poor cooling.
- **External Short Circuits** – Mechanical forces during faults can deform windings if short-circuit strength is inadequate.
- **Design Weaknesses** – Insufficient margins for dielectric or mechanical stresses.
- **Tap Changer Issues** – Contact wear, carbonisation, or lubrication failures.
- **Bushings & Accessories** – Oil leaks, moisture ingress, or partial discharge leading to dielectric breakdown.
- **Operational Events** – Overvoltages, harmonics, or improper switching

Most Frequent Cause of Failure  
(CIGRE Study)



Most Frequent Failing Parts  
(KEMA Failure Statistics)



## Our investigation approach (step-by-step)

Failure is defined as any deviation faced by an asset compared to its expected functionality which requires corrective action. When a failure occurs, a comprehensive failure analysis is essential to identify causes and prevent recurrence. The root causes of a failure may include:

### **1 HISTORY & DATA CAPTURE**

Collect system configuration, load/temperature history, protection operations, site conditions, and installation records

### **2 FIELD DIAGNOSTICS (NON-DESTRUCTIVE)**

If relevant, we typically recommend a site visit by our technicians to gather additional elements, depending on availability and applicability.

### **VISUAL EXAMINATION & LAB TESTING**

**Visual Examination:** map discharge tracks (radial vs longitudinal), carbonization, treeing, or oil/compound residues.

**Material analytics:** tensile/elongation, microtomy & microscopy, TGA/DSC for insulation/semicon, shrinkage, and contamination checks.

**Electrical Testing:** re-testing of cut-outs (impulse, PD, AC withstand) to isolate weak interfaces.

These techniques differentiate workmanship errors from manufacturing or design defects.

### **ROOT-CAUSE ANALYSIS & ALIGNMENT**

Evidence-based RCA, clear cause classification (Design, Production, Installation, External, Ageing, Unknown), and a balanced narrative suitable for technical, legal, and insurance audiences stating the most probable root cause is given.

### **5 PREVENT AGAIN ACTIONS**

Practical mitigations: tightening factory QA (incoming materials, extrusion stability), installer certification & audits, enhanced testing

# Technology, Expertise and long-standing legacy for the Energy Sector

**KEMA** Labs  
—  
**CESI** Group

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